Claims:

1. A modulation method for multiple-tone signalling, including the steps of:

processing input data through a plurality of intermediate processing stages and corresponding stages of intermediate data to generate preprocessed data;

inverse Fourier transforming the preprocessed data to obtain a symbol including a number of tones;

buffering the symbol;

determining the peak amplitude in the symbol and comparing the peak amplitude with a threshold;

if the peak amplitude in the buffered symbol exceeds the threshold, obtaining a regenerated symbol by amending predetermined intermediate data such that the input data is still represented by the intermediate data, carrying out the subsequent intermediate processing stages on the amended intermediate data to regenerate preprocessed data, and inverse Fourier transforming the regenerated preprocessed data to obtain the regenerated symbol,

replacing the buffered symbol with the regenerated symbol; and

outputting the buffered symbol.

2. A method according to claim 1 including, when a regenerated symbol is generated, comparing the peak amplitude in the regenerated symbol with the peak amplitude in the buffered symbol and replacing the buffered symbol with the regenerated symbol only if the regenerated symbol has a lower peak amplitude.

3. A method according to claim 1 including checking if the peak amplitude in the regenerated symbol exceeds the threshold, and if the predetermined amplitude exceeds the threshold, obtaining at least one further regenerated symbol by further amending predetermined intermediate data

such that the input data is still represented by the intermediate data, carrying out the subsequent intermediate processing stages on the amended intermediate data to regenerate preprocessed data, inverse Fourier transforming the regenerated preprocessed data to obtain the further regenerated symbol, and replacing the buffered symbol with the further regenerated symbol.

4. A method according to claim 1 including determining whether there is sufficient processing time to regenerate a symbol before regenerating that symbol.

5. A method according to claim 1 wherein the subsequent intermediate processing stages used to regenerate preprocessed data include a scrambling stage.

6. A method according to claim 5 wherein the scrambling stage is a self scrambling stage in which an internal memory of previous outputs feeds into the computation of subsequent outputs in a recursive manner.

7. A method according to claim 1 wherein the said subsequent intermediate processing stages used to regenerate a symbol include a Reed-Solomon error protection stage.

8. A method according to claim 1 wherein the said subsequent intermediate processing stages used to regenerate a symbol include a trellis encoding stage.

9. A method according to claim 1 wherein the intermediate data includes a series of data frames including fast bytes and/or sync bytes and the step of amending the predetermined intermediate data includes amending the fast or sync bytes of the data frames.

10. A method according to claim 9 wherein the predetermined intermediate data includes fast bytes or sync bytes having default values with at least one freely selectable bit and the step of amending the predetermined intermediate data includes amending at least one freely selectable bit of the fast or sync bytes having default values.

11. A method according to claim 1 wherein the predetermined intermediate data includes idle cells and the step of amending the predetermined intermediate data includes amending at least one idle cell.

12. A method according to claim 11 wherein the step of amending the at least one idle cell includes selecting, for at least one payload byte in said idle cell, an alternative idle cell payload byte value from a predetermined set of idle cell payload byte values, the number of values in said predetermined set being much less than the total number of possible idle cell payload byte values.

13. A method according to claim 1 wherein the step of amending the predetermined intermediate data includes replacing ATM cells one with the other.

14. A method according to claim 13 wherein the step of amending the predetermined intermediate data includes replacing an idle ATM cell with a new data ATM cell.

15. A method according to claim 13 wherein the step of amending the predetermined intermediate data includes swapping two ATM cells from different data streams.

16. A method according to claim 13 wherein the step of amending the predetermined intermediate data includes replacing a data cell with an idle cell.

17. A modulation method for multiple-tone signalling, including the steps of:

processing input data through a plurality of intermediate processing stages and corresponding stages of intermediate data to generate preprocessed data;

transforming the preprocessed data to obtain a symbol including a number of tones; and

if the peak amplitude in the symbol exceeds a predetermined threshold, regenerating the symbol by amending predetermined intermediate data such that the input data is still represented by the intermediate data, and carrying out the subsequent intermediate processing stages and the transforming step on the amended intermediate data.

18. A modulation method for multiple-tone signalling, including the steps of:

processing input data through a plurality of intermediate processing stages and corresponding stages of intermediate data to generate preprocessed data;

transforming the preprocessed data to obtain a symbol including a number of tones;

buffering the symbol;

if the peak amplitude in the symbol exceeds a predetermined threshold, amending predetermined intermediate data such that the input data is still represented by the intermediate data, and carrying out the subsequent intermediate processing stages and the transforming step on the amended intermediate data to obtain a regenerated symbol, and

replacing the buffered symbol with the regenerated symbol if a predetermined condition applies.

19. A method according to claim 18 wherein the predetermined condition is that the peak amplitude in the regenerated symbol is less than that of the buffered symbol.

20. A computer program product for causing a data processor to carry out the steps of:

processing input data through a plurality of intermediate processing stages and corresponding stages of intermediate data to generate preprocessed data;

inverse Fourier transforming the preprocessed data to obtain a symbol including a number of tones;

buffering the symbol;

determining the peak amplitude in the buffered symbol and comparing the peak amplitude with a threshold;

if the peak amplitude in the buffered symbol exceeds the threshold, obtaining a regenerated symbol by amending predetermined intermediate data such that the input data is still represented by the intermediate data, carrying out the subsequent intermediate processing stages on the amended intermediate data to regenerate preprocessed data, and inverse Fourier transforming the regenerated preprocessed data to obtain the regenerated symbol,

replacing the buffered symbol with the regenerated symbol; and

outputting the buffered symbol.

21. A computer program product according to claim 20 for carrying out the steps of comparing, when a regenerated symbol is generated, the peak amplitude in the regenerated symbol with the peak amplitude in the buffered symbol and replacing the buffered symbol with the regenerated symbol only if the regenerated symbol has a lower peak amplitude.

22. A computer program product according to claim 20 for carrying out the step of checking if the peak amplitude in the regenerated symbol exceeds the threshold, and if the predetermined amplitude exceeds the threshold, obtaining at least one further regenerated symbol by further amending predetermined intermediate data such that the input data is still

represented by the intermediate data, carrying out the subsequent intermediate processing stages on the amended intermediate data to regenerate preprocessed data, inverse Fourier transforming the regenerated preprocessed data to obtain the further regenerated symbol, and replacing the buffered symbol with the further regenerated symbol.

23. A computer program according to claim 20 wherein the subsequent intermediate processing stages used to regenerate preprocessed data include a scrambling stage.

24. A transmitter for transmitting multiple tones representing input data, comprising:

a processor for generating preprocessed data from the input data through a series of intermediate processing stages, intermediate data being transmitted between each pair of intermediate processing stages;

an inverse Fourier transform module for carrying out an inverse Fourier transform on the preprocessed data to obtain a symbol including a number of tones;

a buffer for storing the symbol;

a peak detector for detecting the peak amplitude in the symbol and comparing the peak amplitude with a threshold;

and a regeneration control system for causing the processor, if the peak amplitude in the symbol exceeds the threshold, to carry out the steps of :

amending predetermined intermediate data such that the input data is still represented by the intermediate data;

regenerating preprocessed data by executing the subsequent intermediate processing stages on the regenerated data;

inverse Fourier transforming the regenerated preprocessed data to obtain a regenerated symbol including a number of tones; and

replacing the symbol stored in the buffer with the regenerated symbol; and

a digital to analogue converter for converting the symbol to an analogue signal having multiple tones.

25. A modulator for a multi-tone transmission system including:

a processor having a plurality of intermediate processing stages for processing input data through stages of intermediate data to generate preprocessed data;

a transform unit for transforming the preprocessed data to obtain a symbol including a number of tones; and

a regeneration control unit for regenerating the symbol if the peak amplitude of the symbol exceeds a predetermined threshold, by amending predetermined intermediate data such that the input data is still represented by the intermediate data, and carrying out the subsequent intermediate processing stages and the transforming step on the amended intermediate data.

26. A multi-tone modem including:

a processor having a plurality of intermediate processing stages for processing input data through stages of intermediate data to generate preprocessed data;

a transform unit for transforming the preprocessed data to obtain a symbol data stream of symbols including a number of tones;

a buffer for storing the symbols of the symbol data stream;

a regeneration control unit for regenerating a symbol of the symbol data stream only if the peak amplitude of the said symbol exceeds a predetermined threshold, by amending predetermined intermediate data such that the input data is still represented by the intermediate data, carrying out the subsequent intermediate processing stages and the transforming step on the amended intermediate data, and replacing the said symbol in the buffer with the regenerated symbol; and

a line driver for outputting the symbols stored in the buffer down a transmission line.

27. A multi-tone transmission system, including

a transmitter for transmitting multiple tones representing input data, comprising:

a processor for generating preprocessed data from the input data through a series of intermediate processing stages, intermediate data being transmitted between each pair of intermediate processing stages;

an inverse Fourier transform module for carrying out an inverse Fourier transform on the preprocessed data to obtain a symbol including a number of tones;

a buffer for storing the symbol;

a peak detector for detecting the peak amplitude in the symbol and comparing the peak amplitude with a threshold;

and a regeneration control system for causing the processor, if the peak amplitude in the symbol exceeds the threshold, to carry out the steps of :

amending predetermined intermediate data such that the input data is still represented by the intermediate data;

regenerating preprocessed data by executing the subsequent intermediate processing stages on the regenerated data;

inverse Fourier transforming the regenerated preprocessed data to obtain a regenerated symbol including a number of tones; and

replacing the symbol stored in the buffer with the regenerated symbol;

a digital to analogue converter for converting the symbol stored in the buffer to an analogue signal having multiple tones;

a transmission line connected to the output of the digital to analogue converter for transmitting the analogue signal; and

a receiver connected to the other end of the transmission line to the transmitter for receiving and decoding the analogue signal transmitted down the transmission line from the transmitter.